NOTES RELATING TO THE FLORA OF BHUTAN: XXXIX. *GRAMINEAE* II

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The following descriptions of new taxa, new combinations, lectotypifications, and nomenclatural notes are required for the forthcoming volume of the *Flora of Bhutan* (volume 3, part 2, *Gramineae*). New species: *Agrostis ushae* Noltie from India (Sikkim), *Arundinella dagana* Noltie and *Cymbopogon bhutanicus* Noltie from Bhutan. New subspecies: *Deschampsia cespitosa* subsp. *sikkimensis* Noltie from India (Sikkim) and China (Tibet). New combinations: *Agrostis petelotii* (Hitchc.) Noltie, *Urochloa supervacua* (C.B. Clarke) Noltie, *Cymbopogon munroi* (C.B. Clarke) Noltie, *Urochloa villosa* var. *barbata* (Bor) Noltie, *Themeda triandra* var. *laxa* (Andersson) Noltie. The following species are reported here for the first time from the following countries. Bhutan: *Neyraudia curvipes* Ohwi, *Tripogon purpurascens* Duthie, *Elymus duthiei* (Melderis) G. Singh, *Urochloa panicoides* P. Beauv., *Spodiopogon lacei* Hole, *Microstegium falconeri* (Hook.f.) Clayton. China (Yunnan): *Agrostis zenkeri* Trin. Bangladesh: *Panicum laxum* Sw.

Keywords. Bangladesh, Bhutan, China, *Gramineae*, India, lectotypifications, new combinations, new records, new taxa, Sikkim, Tibet.

INTRODUCTION

This paper includes nomenclatural notes and descriptions of new taxa for the forthcoming volume on the grasses of Bhutan (*Flora of Bhutan*, volume 3, part 2). It covers all tribes except for *Stipeae*, on which notes have already been published (Noltie, 1999), and *Bambuseae*, which have been treated by Stapleton (1994a, 1994b, 1994c, 1999). In addition, several new records are given where they represent interesting disjunctions. The order of treatment within the paper follows Clayton & Renvoize (1986), whose generic treatment has largely been followed in the *Flora* account. The new taxa will be illustrated in the *Flora*.

The grasses of Bhutan have not previously been studied systematically, though those of adjacent Sikkim are relatively well known, at least as regards historical collections. A great deal of work remains to be done, particularly on critical genera such as *Calamagrostis*. Despite this, much interesting taxonomic and distributional information has resulted from the study. Some of this is published here, and much else will be evident in the *Flora* account. Particular tribute must be given to John Wood, Daniel Miller, Rebecca Pradhan, Andrew Grierson and David Long for their fieldwork over the last twenty years: without their collections the account could simply not have been written, as earlier collectors had made very few grass collections. The total number of genera of *Gramineae* for the Flora area (i.e. Darjeeling

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District of West Bengal, Sikkim, the Chumbi Valley (Tibet), the narrow strip of Terai close to the southern border of Bhutan and the Kingdom of Bhutan itself) is 126, of which 9 are represented only by introduced species. The total number of species is approximately 392, of which 65 are introduced/cultivated. Much collecting is still required, particularly in the south of Bhutan and further additions are to be expected; for example, none of the large, Andropogonoid Terai species have so far been collected in Bhutan, but are known (R. Pradhan, pers. comm.) to be present in areas such as the Royal Manas National Park. Because of the critical nature of many species, further specialist collecting trips will be required. This was amply demonstrated on a grass collecting trip that I was privileged to undertake to Bhutan in August–September 1998, which allowed the acquistion of much additional taxonomic, distributional and ecological data.

I. TRIBE *AVENEAE*

Deschampsia

Deschampsia cespitosa (L.) P. Beauv. subsp. **sikkimensis** Noltie, **subsp. nov.**
Syn.: *D. cespitosa* var. *colorata* sensu Hook.f., Fl. Brit. India 7: 273 (1897), non Grisebach.
Inflorescentiis densissimis subsp. *koelerioidi* (Regel) Tzvelev similis sed characteribus sequentibus differt: folia angustiora; inflorescentia ambitu pyramidalis (haud cylindrica), spiculis in glomerulis densis sphaericis aggregatis, ramulis primariis evolutis vel haud evolutis; glumae majores, inferior 3.6–4.5mm (non 3–3.6mm), superior 4–4.8mm (non 3.6–4.2mm).
Type: India, Sikkim, Upper Lasha Chhu valley, below Yulhe Khang glacier, 4545m, 20 vii 1996, *Edinburgh Expedition to Northern Sikkim (EENS)* 359 (holo. E; iso. BSHC).

Compact, densely tufted perennial. *Culms* 8.5–24cm, erect, bearing a single leaf in lower third. *Culm leaf*: blade 0.9–3 × c.0.2cm, short, becoming inrolled, glabrous or minutely rough on veins above; sheath long, covering half or more of culm, glabrous, ligule c.4mm, lacerate. *Leaves* of vegetative shoots: blades 3.6–19 × c.0.1cm, inrolled, glabrous; sheaths papery, pale brown. *Inflorescence* golden, tinged purplish, 3–7cm, spikelets in dense, rounded clusters 1–1.5 × 1–1.3cm at ends of short (0.3–1.2cm) branches, or branches not developed when inflorescence densely pyramidal-ovoid. *Spikelets* 4.2–5mm, 2- or 3-flowered. *Glumes* dark purplish, with golden-hyaline margins and apex, sometimes green in centre, oblong-lanceolate, acuminate, papery, sometimes minutely toothed near apex, the lower 3.6–4.5 × c.1mm, the upper 4–4.8 × c.1.5mm. *Lower floret*: callus hairs 1–2mm; lemma purplish below, hyaline above, 3.3–3.6mm, oblong, truncate-erose; awn inserted about or below middle, straight, shorter than lemma (1–3.2mm); palea 3–3.5mm; anthers dark purple or cream, 1.3–1.9mm. *Lowest rachilla internode* 0.8–1.1mm, hairs 0.5–1mm.

Other specimens seen. INDIA. Sikkim: Momay, Sept. [1849], *J.D. Hooker*, s.n. (K); Samding, 16,000ft, 11 ix 1849, *J.D. Hooker*, s.n. (K – mixed sheet with specimens approaching subsp. *cespitosa* probably collected at Tungu); Naku La, 17,290ft, 23 viii 1972, *Pradhan, Norbu & Naku* 163 (E); Chholhamoo, 17,820ft, 18 viii 1972, *Pradhan, Norbu & Naku* 146 (E).

CHINA. S Tibet [N of Kumaon]: Balch Pass, 16,500ft, *Strachey & Winterbottom* s.n. (K).

There are no habitat notes on any of the old specimens, but the type specimen was collected in shallow runnels at the edge of a fast-flowing river.

D. cespitosa is a very widespread and polymorphic species; it is difficult to deal with the variation taxonomically, which has resulted in various different treatments. For example, the taxon to which this plant is closest has been recognized at specific rank by Cope (1982) and subspecific rank by Tsvelev (1984), who recognized 17 subspecies of *D. cespitosa* in the former USSR. More or less typical *D. cespitosa*, a tall plant with a very lax panicle, is not uncommon in Bhutan and Sikkim between 3050 and 4880 metres.

The new subspecies was first recognized by Hooker (1897) at varietal rank under a name that applies to a form described from the Rhodope Mountains (Bulgaria). It approaches *D. cespitosa* subsp. *koelerioides* which occurs in C Asia and NW Himalaya (N Pakistan, Kashmir, Baltistan), i.e. further north and west than subsp. *sikkimensis*. The spikelets of both the C Asian and Sikkim taxon differ from those of *D. cespitosa* in only slight ways and are characterized by their dense inflorescences. Given the disjunct distribution and the slight differences between other recognized subspecies, however, it seems worth describing the Sikkim plant at subspecific rank.

Agrostis, Calamagrostis *and related genera*

There are really no clear-cut characters or character combinations to distinguish *Agrostis* from *Calamagrostis*. The genera *Deyeuxia*, *Aniselytron* and *Anisachne* that are very close to *Calamagrostis* have also been recognized from our area in the past. There is no consensus over which of these genera should be recognized in floristic treatments of adjacent regions. The characters traditionally used to separate these genera include texture of glumes, induration of lemma, relative lengths of glumes and lemma, size of spikelets, presence/length of callus hairs and development of a rachilla rudiment, but all of these are variable and occur in various combinations. Without wishing to get deeply involved in the subject for the *Flora* account, I have chosen to follow the pragmatic approach of Clayton & Renvoize (1986). They separate *Agrostis* from *Calamagrostis* on fairly subjective characters as follows:

1a. Lemma hyaline to cartilaginous, callus beardless or rarely with hairs up to half its length; inflorescence typically open, of small spikelets ——— **Agrostis**

1b. Lemma firmly membranous to coriaceous (indurated), rarely hyaline and then with a callus beard as long as itself; inflorescence typically denser, of larger spikelets ——— **Calamagrostis**

Of the related genera, they sink *Deyeuxia* and *Aniselytron* under *Calamagrostis* with

which I agree, but their placement of *Anisachne* requires further discussion (see below).

Agrostis zenkeri *and allies*

There has been much confusion over the generic placement, synonymy and origin of the type of *A. zenkeri* Trin., a species characterized by small spikelets and the presence of a penicillate rachilla extension and callus hairs. Much ink has already been spilled but, regrettably, it is necessary to add to it. *A. zenkeri* was described by Trinius, based on a single specimen said to come from the Nilgiri Mountains in S India, and therefore assumed (see Bor, 1954b) to have been collected by B. Schmid. All subsequent collections, however, have been from NE India (and more recently China). Either there was a mistake in labelling or, if it does occur in the Nilgiris, it must be extremely rare, as it has not been re-collected there. By the time Trinius wrote his paper (1841), he had seen grass specimens from the NW Himalaya (collected by Hügel and Royle), but it is not certain that he had seen specimens of any taxa from Khasia or the E Himalaya, hence the mystery of how a label switch could have occurred. Regardless of this I disagree with Korthof and Veldkamp (1985) who claim that the type of *A. zenkeri* is like no other 'American, Asian, Australian, European or Indian species known to us' and I see no reason whatsoever to disagree with most of the conclusions of Bor (1954b).

Hooker (1897) treated *A. zenkeri* as a 'doubtful species' and described the new *Deyeuxia abnormis* (based on a manuscript name of Munro) citing specimens from Sikkim (*Hooker, Agrostis* 11) and Khasia (*Hooker & Thomson, Agrostis* 12 and '*Griffith*, &c [*Clarke*]'). There are 12 syntype sheets at Kew annotated with the name in Hooker's hand, but unfortunately these bear two similar taxa: of these five bear what I propose to call *A. petelotii*, six bear *A. zenkeri*, and one bears both. The protologue includes both elements, but Hooker describes one character that enables the name to be applied unambiguously to one of the elements: 'gl. III [lemma] rather shorter than I [lower glume]'.

Korthof & Veldkamp (1985) lectotypified the name *D. abnormis* choosing *Hooker & Thomson, Agrostis* 12, having seen duplicates at L. They did not see any of the Kew material, and cited 'Lectotype ... K, holo, *n.v.*; L'. As the two L specimens are of the same taxon (the one I propose to call *A. petelotii*) they saw no reason to doubt that there would be a 'hololectotype' representing the same taxon at Kew. However, as we have seen above, two taxa are represented among the syntypes. In any case Bor (1954b) had effectively lectotypified the species earlier on a sheet of *Agrostis* 12 from Surureem, Khasia bearing the Hooker & Thomson field number 1232. This sheet must, however, be rejected (Art. 9.13) as the lectotype as it does not agree with the important part of the protologue quoted above.

It must be realised that '*Agrostis* 12' is not a unique collecting number, rather an aggregate 'species number' and Hooker applied it to several sheets of what he believed to be the same species collected in Khasia. There are three of these, annotated by

Hooker, at Kew (with duplicates in other herbaria, e.g. BM, L). There is therefore no 'holo[lecto]type' at K and of the three sheets there, two bear a species that disagrees with the important element of the protologue quoted above and one bears a mixture of two taxa. It is thus necessary to select an element from this material that agrees with the protologue. While it is possible to retain part of *Agrostis* 12 (following Bor, and Korthof & Veldkamp) as a lectotype it is necessary to be more specific. That Bor was aware of a conflict in his application is shown by an annotation on his own copy of the *Flora of British India* at Kew – against 'III rather shorter than I' he has written 'no, longer'.

I therefore propose to lectotypify on the right hand specimen of the mixed sheet of *Agrostis* 12 (Nonkreem, Khasia) which shows Hooker's important diagnostic character of the short lemma. This will also cause the least nomenclatural disturbance as *D. abnormis* thereby becomes a synonym of *A. zenkeri*, as it has commonly (if for the wrong reason) been taken.

This leaves the need for a name for the second element of *D. abnormis*. In 1921 Mez described *Agrostis pleiophylla* based on two Clarke sheets from Khasia and Darjeeling; their numbers were not cited in the protologue but fortunately they are extant at B (*Clarke* 44736B from Khasia and *Clarke* 26852 from Darjeeling). Surprisingly there are no duplicates of either of these numbers at K. In the protologue Mez makes no mention of a rachilla extension and it was therefore surprising that Bor took the species to be synonymous with *A. zenkeri*. Korthof and Veldkamp (1985) assumed the types to be destroyed, cited non-existent syntypes at Kew and sunk *A. pleiophylla* under *D. abnormis*. The two syntype sheets in B in fact bear three different taxa: *A. micrantha*, *A. petelotii* and an unidentifiable species. A hairy rachilla extension is present only on the weakest of the Khasian specimens and unfortunately Bor seems not to have noticed that this was different from the other two. For purposes of typification this specimen must be discounted, as not agreeing with the most important parts of the protologue. The only part of the description that refers to this specimen is the character of a branched culm, but the important description of the spikelets (and Mez's drawings on the sheets) applies equally to the other two. I propose lectotypifying (see below) on the left-hand Khasia specimen, in which case *A. pleiophylla* can be sunk under *A. micrantha* Steud. The Darjeeling specimen remains a puzzle, but as it is incomplete, with no basal parts, it is best ignored.

Keng described the new genus and species *Anisachne gracilis* in 1958, commenting on its closeness to *Agrostis zenkeri*. The holotype has not been seen, but two Yunnan specimens determined by Y.C. Tong at E, one of which is a paratype, and from the clear illustration accompanying the protologue, there is no doubt about its identity with the second element of Hooker's *D. abnormis*. The monotypic genus *Anisachne* is still recognized in Chinese literature (Kuo, 1987), but Clayton & Renvoize (1986) sunk it under *Calamagrostis*. It is now clear that it should actually be sunk under *Agrostis*. There is, however an earlier description of the species: as *Aulacolepis petelotii* Hitchcock, 1934, from Vietnam. The type of this has been studied and

matches the second element of *D. abnormis*, differing only in having slightly more robust culms and wider leaves than the Bhutanese and Khasian specimens. A new combination, however, is required in *Agrostis*.

Bor described *Agrostis nagensis* based on a single specimen from Nagaland. With more specimens now available from Bhutan it can be seen to be merely an extreme form of *A. zenkeri* with rather large spikelets.

The following synonymy and typification can be made:

Agrostis zenkeri Trin., in Mem. Acad. Sc. St Petersburg, ser. VI (2): 363 (1841). Type: India, 'Nilagiri, *Zenker*' (holo. LE *n.v.* [Hb. Trinius 1669.01, IDC microfiche BT-16/1]; photo at K!).

Syn.: *Calamagrostis zenkeri* (Trin.) Davidse, Fl. Ceylon 8: 107 (1994), name only.

Deyeuxia abnormis Hook.f., Fl. Brit. India 7: 268 (1897), p.p. Type: India, Khasia, Nonkreem, 10 x 1850, *Hooker & Thomson, Agrostis* 12 (right-hand specimen, with branched culm) (lecto. selected here, K).

Agrostis nagensis Bor, in Kew Bull. 9: 497 (1954). Type: India, Nagaland, Japvo, 8000ft, 28 ix 1935, *Bor* 6449 (holo. K).

Deyeuxia nagensis (Bor) Veldkamp, in J. Econ. Tax. Bot. 13: 74 (1989).

Specimens seen. INDIA. Sikkim: *Kurz* s.n. (K); *Hooker, Agrostis* 11 (K). Meghalaya (Khasia): *Griffith HEIC (KD)* 6663 (K); *Assam Deputation* s.n. (K); *Hooker & Thomson, Agrostis* 12 (in small part) (K); *Clarke* 15413, 16055A, 19627, 43575A (K), 45769A (E); *Bor* 17927 (part), 17928 (K). Nagaland: *Bor* 6449 (K).?Tamil Nadu (Nilgiris): '*Zenker*' [*Schmid*] s.n. (LE, n.v.).

BHUTAN. *Wood* 5800, 5860, 6692 (E); *Pradhan & Wangdi* EG 109 (E); *Noltie, Pradhan, Sherub & Wangdi (NPSW)* 15, 215, 238, 286, 352 (E).

CHINA. Yunnan: *Forestry Commission, Edinburgh Expedition to Deqen (FED)* 165 (E), *Maire* 2978 (E).

Note: the origin of the type as from the Nilgiris must remain unconfirmed. The Yunnan records are the first for China.

Agrostis petelotii (Hitchc.) Noltie, **comb. nov.**

Basionym: *Aulacolepis petelotii* Hitchc., in J. Washington Acad. Sc. 24: 291 (1934). Type: Vietnam, environs de Chapu, c.1900m, viii 1933, *Pételot* 4743 (holo. US; iso. P, *n.v.*).

Syn.: *Deyeuxia abnormis* Hook.f. p.p. (*Hooker & Thomson, Agrostis* 12, p.p., Khasia).

Anisachne gracilis Keng, in J. Washington Acad. Sc. 48: 117 (1958). Type: China, Kweichow, Pichieh Hsien, 1400m, 1 vi 1934, *Hou Hsueh-yuh* 2143 (holo. N, *n.v.*).

Specimens seen. INDIA. Arunachal Pradesh: *Kingdon-Ward* 13905, 14001 (E, BM); 13880, 14172A, 14174 (BM). Meghalaya (Khasia): *Hooker & Thomson, Agrostis* 12 (in large part) (K, E, L. BM); *Clarke* 15413C, 38339, 38350, 38526 (K), 44382 (K, BM); 44736B (B); *Koelz* 23090, 23175 (K); *Rup Chand* 7929, 7946 (K); *Bor* 17805 (K). Manipur: *Kingdon-Ward* 17882 (K).

BHUTAN. *Ludlow & Sherriff* 3512 (BM); *Grierson & Long* 2628 (E); *Miller* 166, 273 (K); *Wood* 5668, 5795, 5841, 6727 (E); *NPSW* 12, 17, 47, 86, 159, 180, 221, 232A, 237 (E).
CHINA. Yunnan: *Rock* 10693 (E); *Maire* 1296/1913 (E).
VIETNAM. *Pételot* 4743 (US).

The two species appear to be sympatric, occurring in NE India, Bhutan, Vietnam and Yunnan; they are very similar, but can be separated as follows:

1a. Lower glume usually exceeding lemma, (2.1–)2.5–3.5mm, finely acuminate, tip often curved, glumes conspicuously unequal, the lower (2–)2.1–3mm. Longest callus hairs (1.3–)1.8–2.5mm, more than half lemma. Plants weakly tufted; culms large, often scrambling; basal leaves not conspicuous at flowering; sheaths of culm leaves very scabrid. Inflorescence very lax (secondary and tertiary branches well developed), ±cylindric, pedicels filiform, flexuose ——— **A. zenkeri**

1b. Glumes usually shorter than lemma (floret exserted), the lower glume 1.6–2(–2.3)mm, subacute, glumes equal. Longest callus hairs 0.5–1mm, less than half lemma. Plants densely tufted; culms relatively short; basal leaves numerous, filiform; sheaths of culm leaves smooth. Inflorescence less effuse (secondary and tertiary branches scarcely developed), ±triangular in outline, pedicels not flexuose ——— **A. petelotii**

Note: the longest callus hairs are attached at the base of the lemma margins and should not be confused with the hairy rachilla extension (which in immature florets is appressed to the palea and hidden by the lemma margins).

Calamagrostis debilis *and* C. treutleri

Korthof and Veldkamp (1985) also treated two other species of problematic generic placement which occur in our area:

The Sikkimese *Calamagrostis debilis* Hook.f. they transferred to *Deyeuxia*. *C. debilis* is known only from Hooker's type from Sikkim. It was transferred by Bor (1960), without comment, to *Agrostis*, thereby making an illegitimate combination (there was already an *Agrostis debilis* Poir., 1810), for which Bennet & Raizada coined the new name *A. neodebilis*. Even if one recognizes *Deyeuxia* the transfer there is unwarranted, as the lemma is membranous and there is no rachilla extension. The question is whether it is better placed in *Agrostis* or *Calamagrostis*. While intermediate between the two genera, on the basis of spikelet size (c.4mm), and long callus hairs, it seems best retained in *Calamagrostis*.

The widespread SE Asian *Calamagrostis treutleri* (Kuntze) U. Shukla they place in *Aniselytron*. As stated above I have chosen to follow Clayton & Renvoize (1986) who admit that whilst the SE Asian species of *Aniselytron* look distinct, the genus cannot be maintained when Australian species of *Calamagrostis* (including *Deyeuxia*) are considered.

Agrostis brachiata

This very distinctive species has long been a puzzle, known only from the type specimens; more can now be said about it. Bor (1960) was the first to point out its similarity to a then unpublished Chinese taxon, eventually validly published (Keng, 1984) as *A. megathyrsa* Keng ex P.C. Keng. Recent collections show the two taxa to be identical. The origin of *A. brachiata* given in Hooker (1897) and Bor (1960) is mistaken: the *Wallich Catalogue* gives the source of *Wallich* 3769C as 'Montes Monghir, 1820'. This locality is in Bihar Province, south of the Ganges, which seemed suspicious for a plant that appeared to be temperate. The specimen in K-W, however, bears the field ticket 'Sheopore, 4 ix 1821', and was thus collected by Wallich himself in Nepal. On a recent expedition to Bhutan the plant was found in oak forest at 2700m in the Thimphu valley. Thus the species can be confirmed as a Sino-Himalayan species.

The following synonymy and distribution can therefore be given:

A. brachiata Munro ex Hook.f., Fl. Brit. India 7: 256 (1897) Type: Nepal [mis-cited as Bihar, see above], *Wallich* 3769C [mis-cited as 3769B] (holo. K; iso. K-W, E).
Syn.: *A. megathyrsa* Keng ex P.C. Keng, in Bull. Bot. Res. 4(3): 197 (1984). Type: China, Sichuan, Nan-chuan Xien, Jin-fo-shan, 6 ix 1943, *Y.L. Keng & P.C. Keng* 3876 (holo. N, *n.v.*).

Specimens seen. NEPAL. *Wallich* 3769C (K, K-W, E).
BHUTAN. *NPSW* 32 (E, THIM).
CHINA. Sichuan: *Keng & Keng f.* 3893 (collected at same time as type) (K). Yunnan: *Maire* 6863, 7090 (BM); Hubei: *1980 Sino-Amer. Exped.* 1321 (E).

Its very effuse panicle led Wallich to identify it as a *Sporobolus*. Its spikelets, however, are almost indistinguishable from those of *Agrostis micrantha* Steud. It is distinguished from the latter only by its large, scrambling habit and massive, lax inflorescence and the tendency for the glumes to be deciduous.

Agrostis ushae Noltie, **sp. nov.**
Forma inflorescentiae *A. inaequali* Griseb. similis, sed characteribus sequentibus differt: planta magis robusta, folia basalia latiora; lemmata majora (c.1.9mm, non usque ad 1.5mm), aristata; antherae longiores (0.8–0.9mm, non 0.4–0.5mm). *A. hugonianae* Rendle etiam similis, quae a specie nova spiculis majoribus (3–3.9mm longis), glumis subaequalibus, lemmate longiore (c.2.6mm) et in varietate typica haud aristato recedit. Ab *A. hugoniana* var. *aristata* Keng ex Y.C. Yang inflorescentia densiore et arista infra dimidio inserta differt.
Type: India, Sikkim, Upper Lasha Chhu valley, below Yulhe Khang glacier, 4545m, 20 vii 1996, *EENS* 360 (holo. E; iso. BSHC).

Tufted perennial. *Culms* 5–10cm, bearing 2 leaves on lower quarter. *Culm leaves*: blades 15–30 × 1.8–2mm, narrowly lanceolate, acute, flat, minutely hispid above,

beneath and on margins; sheath of upper leaf covering most of culm, glabrous, ligule c.2mm, rounded-ciliate, minutely hispid on back. *Basal leaves* to 9.5cm, to 2.6mm wide. *Inflorescence* 3–5 × 0.5–1cm, purple, narrowly cylindric, dense, branched to 3 orders; branches slender, hispid, stiffly appressed, whorled, lowest whorl of 3–4 branches, the longest 2.1–3cm; pedicels 1.5–2mm, slender, hispid. *Spikelets* 2.5–3mm; glumes unequal, papery, 1-veined, purple, green around midrib, 1-veined; the lower 2.5–3 × 1.1–1.2mm, widely lanceolate, acuminate, keel hispid; the upper 2.2–2.5 × c.1mm, oblong-lanceolate, subacute. *Floret*: lemma c.1.9 × 1.3mm, oblong-ovate, hyaline, glabrous, apex blunt, minutely ciliate, 5-veined, awned; awn arising below halfway, 2.9–3.3mm, weakly geniculate, purple above; palea minute, c.0.2mm or absent; callus with a few minute hairs (0.1–0.2mm); anthers purple, 0.8–0.9mm.

This distinctive species is known only from the type specimen; a high alpine, it grew in runnels at the edge of a river. It is named after Usha Ganguli Lachungpa, of the Wildlife Section of the Sikkim Forest Department, who has added so much to our knowledge, and worked so hard for the conservation, of the wildlife of northern Sikkim.

Close to *A. hugoniana*, from China (Kansu and Shensi), from which it differs as described above. No material has been seen of *A. hugoniana* var. *aristata*, described from Yunnan and Sichuan, but it differs from the description and illustration (Yang, 1984) as given above. This variety might turn out to be synonymous with the new species, but specific rank seems more appropriate given the small differences between species in *Agrostis*.

Agrostis micrantha

In the light of a large number of recent collections, it is impossible to maintain *A. myriantha* Hook.f. and *A. himalayana* Bor as distinct from the earlier *A. micrantha* Steud. This is the commonest member of the genus at moderate elevations in the E Himalaya. On a recent field trip to Bhutan, it was found to be extremely plastic and subject to environmental modification. In habit it can vary from neat, tufted plants with culms under 20cm, to large sprawling plants with leafy culms to almost one metre. In damp conditions there is a tendency for the culm bases to become decumbent and root from the lower nodes, and in some cases, when the vegetative shoots do the same, it can superficially resemble *A. stolonifera* L. (from which it can be told by its smaller spikelets and anthers). The inflorescence shape is also variable: the branches usually ascend after anthesis to form a rather narrow, dense inflorescence, but in some forms it is laxer, with the branches remaining spreading. Elements within the variable species admittedly look rather distinct in terms of leaf width, production of vegetative shoots and spikelet size.

The form with wide leaves and lush vegetative growth was described by Hooker (1897) as *A. myriantha*, who stated it to be very close to *A. micrantha*. Hooker included smaller specimens from Sikkim and larger ones from Khasia in the pro-

tologue, calling the former 'var. *sikkimensis*' and the latter 'var. *khasiana*'. One of the varietal names is thus superfluous and as the description includes both elements, either could be selected as the type variety. In the protologue the only specimen number mentioned is *Hooker, Agrostis* 7. Of the syntype sheets bearing this number at Kew three come from Sikkim and one from E Nepal. As it is this variety that Hooker lists first, and as Stapf attached a 'Type' label to one of the Sikkim sheets, there seems no reason not to designate this formally as the lectotype of the species as it is a good specimen and agrees with the protologue. This makes var. *sikkimensis* superfluous. It should be noted that none of these specimens bear the name *A. myriantha* in Hooker's hand. It is also necessary to lectotypify var. *khasiana*. Of the sheets in the type cover at Kew none are annotated with the name by Hooker. Some are annotated with the name *A. wightii* Nees, which Hooker (1897) cited as a partial synonym of *A. micrantha*, and can therefore be discounted. The remaining three sheets are labelled *Hooker & Thomson, Agrostis* 8 and bear no field labels. While it is odd that this number is not mentioned in the protologue it seems reasonable to designate one of these as the lectotype as they agree with the protologue of var. *khasiana*, and I choose the one with the most mature inflorescences.

A. himalayana was described by Bor (1953a) based largely on its small spikelets, and more equal glumes, but is connected to *A. myriantha* by intermediates. The spikelet size of some of the syntypes of the latter collected by Hooker in Sikkim in fact come within the range given for *A. himalayana*. Examination of several isotypes (*Wallich* 3776, E) of *A. micrantha* show it to be similarly variable in spikelet size (1.5–2.25mm); the specimens lack basal parts and vegetative shoots but seem to me well able to accommodate the other species. Similar variability is seen in *A. nervosa* Nees ex Trin. and *A. pilosula* Trin.

The following synonymy and typification can therefore be made:

Agrostis micrantha Steud, Syn. Pl. Glum. 1: 170 (1854). Type: Nepal, *Wallich* 3776 (iso. E, K-W).

Syn.: *A. myriantha* Hook.f., Fl. Brit. India 7: 257 (1897). Type: India, Sikkim, Lachen, 9–10,000ft, 2 viii 1849, *Hooker & Thomson, Agrostis* 7 (lecto. selected here, K).

A. myriantha var. *sikkimensis* Hook. f., Fl. Brit. India 7: 257 (1897), *nom. superfl.*

A. myriantha var. *khasiana* Hook. f., Fl. Brit. India 7: 257 (1897). Type: India, Khasia, *Hooker & Thomson, Agrostis* 8 (part: sheet with two mature inflorescences) (lecto. selected here, K).

A platyphylla Mez in Fedde Repert. 17: 302 (1921). Type: India, Khasia, *Hook. & Thomson, Agrostis* 8 (part) (holo. B, *n.v.*; photo K!).

A. himalayana Bor in Kew Bull. 8: 269 (1953). Type: India, Arunachal Pradesh, Nyukmadung, 7000ft, 28 v 1935, *Kingdon-Ward* 11538 (holo. BM; iso. E).

A. pleiophylla Mez in Fedde Repert. 17: 301 (1921). Type: India, Khasia, Soynung, 5000ft, 12 ix 1886, *Clarke* 44736B (left-hand specimen) (lecto. selected here, B).

II. TRIBE *ARUNDINEAE*

Danthonia

There has been much confusion over the identity and nomenclature of a widespread Sino-Himalayan species of *Danthonia* since the account in *Flora of British India*. In this account Hooker (1897) misapplied the name *D. cachemyriana* Jaub. & Spach, which should be restricted to a NW Himalayan species. Bor (1952) realised Hooker's mistake and attempted to resolve the situation, but unfortunately made matters worse. He claimed to make a *nomen novum*, *D. jacquemontii*, for Hooker's plant, but actually described a new species by citing a different type. This name, however, was invalid as there was no Latin description. In any case it would have been superfluous as he cited *D. cumminsii* Hook.f. 1897 as a synonym of a variety he described of the new species (see below). Between the publications of Hooker and Bor, Pilger had described *D. schneideri* from China. H.J. Conert, on annotations in herbaria, realised in the 1960s that Chinese and Himalayan material belonged to the same species for which he used the name *D. schneideri*, but he seems not to have published on the subject. Conert actually annotated the holotype of *D. cumminsii* as '*D. schneideri* var.' The use of the name *D. schneideri* for Himalayan plants was adopted by Cope (1982) in the *Flora of Pakistan*. Hara *et al.* (1978), however, had correctly noted that *D. cumminsii* was an earlier name for *D. schneideri* and that the name *D. jacquemontii* Bor was superfluous.

A further complication arises from the fact that both Hooker and Bor described varieties within their taxa. Hooker described a var. *minor* of his '*D. cachemyriana*' and Bor described a var. *minor* of his invalid *D. jacquemontii*. The latter was based on one of the elements of Hooker's variety, but because the species name was not valid, Bor's varietal name was also invalid. Hooker annotated three sheets with the name var. *minor*, two of his own collections from Sikkim and one from the NW Himalaya (*Strachey & Winterbottom* 2, K). The variety was mainly based on small stature and the protologue does not give measurements for the more important character of glume size. One of the specimens on the Strachey and Winterbottom sheet, however, has long glumes, so it seems wisest to select one of the Sikkim sheets as the lectotype. Bor cited the one with the field label as the 'type' of his invalid variety and there is no reason not to designate this formally as the lectotype of Hooker's var. *minor*.

After studying the large number of specimens available at K and E, it seems impossible to maintain varieties based on spikelet size as was done by Bor (1960). Despite large differences in appearance between some of the specimens in terms of spikelet size and number of spikelets per inflorescence (from 3–60), the variation is continuous and there seems to be no correlation between spikelet size and habitat. Forms with small spikelets occur at both low and high altitudes, and apparently in mixed populations. There is also variability in characters such as presence or absence of hairs on the glumes and the length of the lateral lemma lobes/awns. Much further work is required to work out the basis of this variability and a satisfactory taxonomic

treatment. In the meanwhile, there seems no choice but to agree with Hara *et al.* (1978) and to regard it as a single very variable species. The following more detailed synonymy and typification can therefore be made:

D. cumminsii Hook.f., Fl. Brit. India 7: 282 (1897). Type: [Sikkim], 'Gnatong, Bhootan', pre-1893, *Cummins*, s.n. (holo. K).
Syn.: *D. cachemyriana* sensu Hook.f., Fl. Brit. India 7: 282 (1897), non Jaub. & Spach.

D. cachemyriana var. *minor* Hook.f., Fl. Brit. India 7: 282 (1897). Type: Sikkim, Yeumting, 12,000ft, 2 ix 1849, *Hooker, Danthonia* 2 (lecto. selected here K).

D. schneideri Pilg., in Fedde Repert. 17: 131 (1921). Type: Yunnan, in pratis alpinis ... prope Lichiang, 4200m, 2 ix 1914, *Schneider* 2342 (holo.?B, *n.v.*; iso. K).

D. schneideri Pilg. var. *minor* (Hook.f.) Conert, *ined.*

D. jacquemontii Bor, *nom. invalid.*, Kew Bull. 7: 80 (1952). Based on *Jacquemont* 2068 (K).

D. jacquemontii var. *minor* [Hook.f.] Bor, in Kew Bull. 7: 81 (1952), *nom. inval.* (species name not valid). Based on Hooker's type, but locality mis-cited as 'Geumtong'.

The species occurs throughout the Sino-Himalaya from Pakistan to Yunnan over a surprisingly wide range of altitudes (2520–4267m).

Generic limits in the *Arundineae* are controversial and Clayton & Renvoize (1986) implied that Himalayan taxa traditionally included in *Danthonia* should be placed in the genus *Rytidosperma* Steud., but did not make the relevant combinations; nor have they been made since. *Rytidosperma* is separated from *Danthonia* chiefly on having the lemma hairs arranged in tufts in two rows. In our specimens, however, the hairs are generally distributed over the upper part, or over the whole back, of the lemma, so it seems wisest to retain the traditional generic placement. This was the provisional conclusion reached by Linder & Verboom (1996) in a cladistic analysis of generic limits in the *Rytidosperma* complex: 'the position of the Himalayan species ... are not clear ... the analysis of all species aligns them to the *Rytidosperma* s.l. clade rather than to *Danthonia* ... however, despite these results we do not feel satisfied that we have seen enough good quality, convincing material to make the formal transfer of these species'. Clearly further work is required.

III. TRIBE *ERAGROSTIDEAE*

Neyraudia

Until now *N. arundinacea* (L.) Henr. var. *zollingeri* (Büse) Henr. (syn. *N. reynaudiana* (Kunth) Keng ex Hitchc.) has been the only member of the genus known from Bhutan, where it is very common. Determinations of specimens as *N. arundinacea* var. *arundinacea* have all been shown to be mistaken and that variety appears to be restricted in the subcontinent to the north-west. On a recent collecting trip to Bhutan,

however, a very different species of *Neyraudia* was collected near Deothang in the south-east of the country (*NPSW* 187; E, THIM). This specimen is immature but matches an earlier, very damaged specimen (virtually devoid of florets apart from some diseased remnants), collected at nearly the same locality (*Grierson & Long* 2239, E). These specimens are referable to *N. curvipes* Ohwi, a little known species described from Mount Kinabalu in Borneo. The only way in which the Bornean specimen differs from the Bhutanese ones is in the character referred to in the epithet – the basal rachilla internode is curved. However this seems a trivial character and as the recent specimen is immature it is possible that this character might develop at a later stage. This therefore represents a new, and dramatically disjunct, record for the E Himalaya. It is possible that the species occurs on mountains in Indo-China and has not been collected. These large grasses are awkward to collect, and therefore often ignored by collectors.

Key to Bhutanese taxa

1a. Glumes subequal, lanceolate, finely acuminate; spikelets 5–7-flowered; lower lemma sterile (often adhering to lower glume), epaleate, glabrous ——— **N. arundinacea** var. **zollingeri**

1b. Glumes very unequal, oblong-elliptic, blunt; spikelets 2- or 3-flowered; lower lemma fertile, paleate, margins hairy towards base ——— **N. curvipes**

Tripogon

A thorough modern revision of the Chinese and Indian species of this difficult genus is required. Three species occur in our area, one of which is reported here for the E Himalaya for the first time. Until recently, when reported for Xinjiang, NW China (Chen, 1990) and Arabia (Cope, 1985), *T. purpurascens* Duthie was known only from the NW Himalaya. It has recently been discovered in Bhutan by John Wood, representing a disjunction similar to that of *Elymus duthiei* (Melderis) G. Singh and *Stipa jacquemontii* Jaub. & Spach both also found nearby in the Thimphu valley.

T. filiformis Nees ex Steud. is a very variable species in Bhutan, and occurs over a wide range of altitudes; it is possible that more than one taxon is present. Further work, however, is required on this species, and on Sino-Himalayan specimens referred to *T. bromoides* Roem. & Schult.

The original description of *T. trifidus* Munro ex Stapf is very inadequate: Stapf quotes the Munro ms. name and cites specimens from Sikkim, the Khasia Mountains and Tonkin, but gives no description and diagnoses a new species (*T. lisboae* Stapf) against it. R.K. Brummitt (pers. comm.) takes this diagnosis to be sufficient to validate the name. A description of the plant is given in Hooker (1897), who comments on the difference between the Khasia and Sikkim specimens, but concludes that they are conspecific, with which I agree. There is some doubt, however, as to

whether the specimens on the sheet really come from Sikkim. Hooker's field label reads 'Lachoong, rocks, 15–16000ft, Aug 15th '49', the altitude has been queried and later scored out by Hooker himself, and replaced with '5–6000ft'. It seems possible that this is the wrong field label which might well have belonged to another plant genuinely collected at the higher altitude because other collections from Lachung and its environs, by Hooker, Gammie and Pradhan, are all *T. filiformis*.

Whether or not *T. trifidus* occurs in Sikkim, it is necessary to lectotypify the name, and I choose here the only specimen in the type cover at Kew that bears Munro's ms. name unqueried and in his own hand. This sheet bears three plants, which all agree with the description in Hooker (1897), though it is not annotated by Stapf.

T. trifidus Munro ex Stapf, in Kew Bull. 1892: 85 (1892).
Type: India, Meghalaya, Khasia, *Griffith, HEIC (KD)* 6634 (lecto. selected here, K).

IV. TRIBE *PANICEAE*

Urochloa

There has been much discussion about the generic delimitation (and typification) of *Urochloa* and *Brachiaria*. Veldkamp (1996) and Webster (1987) have recommended restricting *Brachiaria* to *B. eruciformis* (Sm.) Griseb. and a few allied species and transferring the remainder of the large genus (c.100 species) to *Urochloa*. The difference between the genera is, in any case, small. According to Clayton & Renvoize (1986) they differ as follows:

1a. Spikelets adaxial, plump; upper lemma usually not mucronate ..... **Brachiaria**
1b. Spikelets abaxial, plano-convex; upper lemma mucronate ..... **Urochloa**

It should be noted that the spikelet orientation character only applies if the spikelets are borne singly and the definition of a 'mucro' is rather subjective; furthermore problematic intermediates exist. Clayton & Renvoize (1986) commented under *Urochloa* that 'it is a moot point whether generic rank is justified'. Most of the species in our area have been traditionally placed in *Brachiaria*, and *U. panicoides* P. Beauv. has only recently been found in Bhutan (*NPSW* 291; E, THIM). Given the small differences and the presence of intermediates it seems not unlikely that all *Brachiaria* might eventually be sunk under the earlier *Urochloa*. I therefore propose to follow this usage. This requires only one new varietal and one new specific combination for Bhutanese taxa. The latter is necessary because the species concerned has been overlooked and never transferred from *Panicum*.

Urochloa supervacua (C.B. Clarke) Noltie, **comb. nov.**
Basionym: *Panicum supervacuum* C.B. Clarke, in J. Linn. Soc. Bot. 24: 408 (1888).
Type: India, West Bengal, Balasun, 400ft, 28 v 1884, *Clarke* 35103 (lecto. selected here, K; isolecto. [35103A] BM).

Similar to *U. ramosa* (L.) T.Q. Nguyen, but differing as follows: leaves narrower (5–7mm vs. (6–)11–15mm), hairy; spikelets with two sterile florets.

This interesting species was described by Clarke, who cited three syntypes (*Clarke* 35103, 33585, 36932). No. 33585 has not been found, but a sheet at K bears two specimens and two labels with the first and last numbers. A duplicate of 35103 at BM gives the locality, altitude and date lacking on the K label. This matches the left-hand specimen on the Kew sheet, which appears to be associated with the label bearing Clarke's drawing reproduced with the protologue. As it also agrees with the description, it is this specimen that should be designated as the lectotype. The species was overlooked by Hooker (1897) and inexplicably sunk under *Brachiaria ramosa* (L.) Stapf by Bor (1960). It is distinct not only in the exceptional number of florets but also in the narrower, hairy leaves and the shape of the glume and lemma apices (±mucronate, tending towards *Urochloa* in the traditional sense).

Stapf (1919) treated the species as an aberrant form of *B. ramosa* and cited a specimen collected on the Cape Verde Islands. This specimen has since been re-identified as the related *B. lata* (Schumach.) Hubbard and demonstrates that an extra floret can occasionally develop in other species (as it can in other Panicoid genera). No doubt production of an extra floret results from a relatively simple mutation. However, given that our plant has a facies different from that of *U. ramosa*, a distinct distribution and appears to be relatively common, it seems desirable to reinstate Clarke's species. *U. supervacua* appears to be a weedy, subtropical species restricted to the lower Himalaya (to 1700m).

Specimens seen. INDIA. Uttar Pradesh: Nakind, above Dehra Dun, ix 1899, *Duthie* 23068 (K); Moradabad, viii 1843, *Thomson* 297 (K); Saharunpur, *Jameson* s.n. (E) (with *U. subquadripara*). West Bengal: Balasun, Sikkim Terai, 500ft, 13 x 1884, *Clarke* 36932A (K); Silgori, 1 vi 1875, *Clarke* 26495 (BM, K); Dinajpur, ix 1874, *Bignold* (ex herb. *Clarke* 23472) (K, E).

NEPAL. Kanchaupar Dist., Royal Sukla Phanta Wildlife Reserve, Singhpur H.Q., 600ft, 2 x 1975, *Schaaf* 107 (K).

BHUTAN. Punakha district: near Punakha Dzong, 1100m, 3 x 1987, *Wood* 5911 (E); Punakha, 4500ft, 20 v 1914, *Cooper* 2402 (E, BM); Wangdi Phodrang, 1200m, 20 ix 1998, *NPSW* 290 (E, THIM). Mongar district: Lingmethang, 950m, 2 vii 1979, *Grierson & Long* 2417 (E) (with *U. ramosa*); Yayung, 900m, 8 vi 1992, *Parker* 7207 (E). Tashigang district: between Kanglung and Tashigang, 1700m, 13 ix 1995, *Pradhan & Wangdi* EG42 (E); below Tashigang, 700m, 2 v 1988, *Wood* 6269 (E); Gamri Chu, 1300m, 9 ix 1998, *NPSW* 139 (E, THIM); Tashigang, 1300m, 9 ix 1998, *NPSW* 134 (E, THIM).

Urochloa villosa (Lam.) T.Q. Nguyen var. **barbata** (Bor) Noltie, **comb. nov.**
Basionym: *Brachiaria villosa* var. *barbata* Bor, Grasses of Burma, Ceylon, India and Pakistan, p. 286 (1960). Type: Nepal, Arun Valley N of Num, 4500ft, *Stainton* 1374 (holo. K; iso. E, BM).

This variety is characterized by having a tuft of long apical hairs on the upper glume. Although the hairiness of the upper glume of var. *villosa* is rather variable, it seems worth maintaining Bor's variety as it is easily recognized, and appears to be rather

uncommon. An analogous variety (var. *pilicoronata* (Ohwi) Jansen) occurs in the closely related Philippine species *Brachiaria fusiformis* Reeder.

Specimens seen. INDIA. Punjab: *Drummond* 21155 (E, K); *Gamble* 6448A (K). West Bengal: Darjeeling: *Sharma* 115 (K); *ESIK* 1163 (E).
NEPAL. *Wallich* 8735A (E, K); *Stainton* 1374 (K).
BHUTAN. *Wood* 5762, 5984A; *Pradhan & Wangdi* EG 129 (E).

Panicum laxum

A strange species of *Panicum*, with extremely small spikelets (c.1.3mm) was recently found in Bangladesh. It turns out to be *P. laxum* Sw., a tropical S American species. How it came there is a mystery, and the species seems never to have been reported as an introduction in Asia.

Specimen seen. BANGLADESH. Cox's Bazar District: Doapalong Range, Upper Rezu Reserve Forest, open areas by path in partly cleared lowland broad-leaved forest with *Eugenia* and *Dipterocarpus*, 30m, 25 x 1997, *Noltie et al.* 33 (= *Rahman* 2183) (E).

V. TRIBE *ARUNDINELLEAE*

Arundinella dagana Noltie, **sp. nov.**
Species nova inter *A. bengalensem* (Spreng.) Druce et *A. birmanicam* Hook. f. intermedia. *A. bengalensi* forma inflorescentiae et habitu perenni similis sed spiculis majoribus (plus quam 3.5mm longis, non plerumque minus quam 3.2mm), arista lemmatis superioris majore (2.1–2.5mm, non minus quam 1.5mm), gluma inferiore lemma inferius subaequali vel excedenti (haud 0.5–0.9mm breviore) differt. *A. birmanicae* facie tota et in structura spiculae simulans sed habitu perenni et aristis brevioribus recedit.
Type: Bhutan, Sankosh district, Daga Dzong, 1600m, viii 1989, *J.R.I. Wood* 7042 (holo. E; iso. THIM, US).

Perennial; rhizomes short, loosely tufted. *Culms* to 35cm, erect, bearing 5–7 leaves; leaf blades 13–20 × 0.6–1.2cm, lanceolate, finely acuminate, base rounded, slightly clasping, densely hairy above and beneath, hairs spreading, those at base of blade long (to 5mm); sheaths densely hairy; ligule c.0.5mm. *Inflorescence* 17–19cm, narrowly cylindric, branches stiffly appressed, the longest to 5cm. *Spikelets* 3.5–4mm. *Glumes* thickly herbaceous; the lower 3–3.5 × c.1.1mm, equal or exceeding lower lemma, narrowly lanceolate, acuminate, 3-veined, keel hispid, lateral veins with long bristles; the upper 3.2–3.8 × c.1.4mm, similar to lower, but wider and 5-veined. *Lower floret*: lemma 2.5–3 × 0.6–0.8mm, oblong-lanceolate, acute, thinly herbaceous; palea 1.7–1.9 × c.0.4mm, narrowly lanceoalte, hyaline; anthers (immature) c.0.3mm. *Upper floret*: lemma 2–2.3mm, narrowly lanceolate, hyaline, awn geniculate, column 0.8–1mm, brown, twisted, seta 1.3–1.5mm, hyaline; palea 1.8–2mm, narrowly lanceolate, hyaline; anthers 0.7–0.9mm.

The type specimen is extremely hairy and has very broad leaves, which give it a similar appearance to *A. birmanica*, from which it differs as described above. The new species, however, is closer to the widespread and variable *A. bengalensis* (which has forms with very hairy vegetative parts), but differs in the important spikelet characters described above. While having qualms about basing a new species on a single specimen, there seems little choice here and it is to be hoped that further collections will be made. The part of Bhutan in which it was collected is almost totally unexplored botanically, and John Wood is the only western botanist ever to have made collections there.

The plant grew on grassy banks around fields at 1600m.

VI. TRIBE *ANDROPOGONEAE*

New records

Spodiopogon lacei Hole has, until now, been known only from Burma, Thailand and NE India (Manipur). This species is extremely distinctive in having pseudopetiolate, deeply sagittate leaf bases. It was discovered by John Wood in chir pine (*Pinus roxburghii*) forest below Mongar in 1987 and refound there in 1999 (*Wood* 5998, E; *NPSW* 101, 203, E, THIM).

Microstegium falconeri (Hook.f.) Clayton has, until now, been known only from old collections from around Mussoorie and Nainital in the NW Himalaya (India: Uttar Pradesh). It is a small, delicate annual, no doubt easily overlooked and said to grow on walls (presumably naturally on rocks and cliffs) at 1830–2135m. It is superficially very similar to *Arthraxon microphyllus* (Trin.) Hochst., from which it differs in having well-developed, awned, pedicelled spikelets. Hooker based the genus *Ischnochloa* on this species, defined by its non-disarticulating raceme axes, but Clayton (1981) considered this character not to be significant and reduced the genus to *Microstegium*. It was discovered in Bhutan, near Shemgang (Tongsa district) by Ian Broad in 1985 (*Broad*, s.n., E). The specimen, however was initially identified as *Arthraxon sikkimensis* Bor (=*A. microphyllus*). This is the first record of the species for the E Himalaya, but whether or not this is a true disjunction is uncertain – it must be easily overlooked in the field, and should be looked for in Nepal.

Cymbopogon

This difficult genus is in need of revision, despite the worldwide monograph of Soenarko (1977), and that of the Indian species by Bor (1953b, 1954a). The genus is of enormous commercial importance in SE Asia, as aromatic oils are extracted from various species. In E Bhutan (the Kuru Chu and Manas valleys) oil is extracted (by steam distillation) from a species collected from the wild, and forms the basis of an important local industry. On a recent field trip the author was fortunate to meet two people who provided useful information on the industry and the plants:

Neten Drukpa of the Ministry or Agriculture's Renewable Natural Resources Research Centre at Lingmethang and Patma Dorji, a commercial oil extractor at Pahadrang, near Yadi. They told me that two 'species' of 'lemon grass' grow intermingled in the chir pine zone, which they distinguish by leaf texture. One produces a lower yield of oil, which is high in citral, and therefore commercially valuable: this they call '*C. flexuosus*'. The other type is higher yielding, but the oil is rich in piperitone and low in citral and therefore unsaleable: this they call '*C. distans*'. The identifications of the plants were presumably made in India, where the oil is sold.

On the visit in September, there did appear to be two forms – one narrower leaved, later flowering and tasting of menthol/lemon, the other with broader leaves, earlier flowering and lacking the menthol taste. The two cannot be told apart on spikelet characters in the herbarium, however, and no doubt merely represent chemical races of a single species. A similar situation is found in *C. martinii* (Roxb.) J.F. Wats. where two forms distinguishable in the field, but indistinguishable in the herbarium, produce two different types of oil (Bor, 1960).

However, neither of the locally used names is correct. The name *C. distans* has no doubt been applied as the species is relatively narrow-leaved. *C. distans*, however, is a NW Himalayan species of much lower stature and with larger spikelets. The name *C. flexuosus* has no doubt been applied as it is that species which is used for extraction of 'lemon grass oil' in India. However, *C. flexuosus* has a much broader, denser inflorescence, with smaller, wrinkled spikelets, and is mainly Peninsular, being represented in our area by the scarcely aromatic var. *sikkimensis* Bor. The oil-producing Bhutanese plant is closest to *C. pendulus*, but seems different enough to warrant description as a new species.

Cymbopogon bhutanicus Noltie, **sp. nov.**

A *C. pendulo* (Nees ex Steud.) J.F. Wats. foliis angustioribus (3.7–9.8mm, non 7–14mm); spiculis sessilibus angustioribus (1–1.2(–1.3)mm latis non 1.2–1.4(–1.6)mm), alis etiam angustioribus (0.1–0.2mm non 1.7–2mm); pilis in pedicellis internodiisque brevioribus (1.5–2.5mm, non 3–4mm), spatheolis angustioribus, ligula longiore (3.5–6mm, non 1.7–2mm) rotundato usque subacuto (haud truncato), junctura vaginae cum pagina abaxiali folii pilosa differt. A *C. distanti* (Nees ex Steud.) J.F. Wats. culmis elatioribus (non usque ad 90cm), foliis latioribus (non 2–3mm); inflorescentia longiore (non usque ad 30cm); spiculis sessilibus brevioribus (non 6–7(–8.5)mm), latioribus differt.

Type: Bhutan, Mongar district, between Mongar and the Kuru Chu, 1200m, 6 ix 1998, *NPSW* 99 (holo. E; iso. THIM).

Tufted perennial. *Culms* 150–250cm, sometimes waxy below; leaves glaucous, blades to 8.2mm wide, sheaths appressed-hairy on underside at junction with sheath; ligule rather pointed, longer than wide, 3.5–7mm. *Leaves* of vegetative shoots 50–80cm, narrow, 3.7–8.7(–9.8)mm wide, becoming inrolled on drying, strongly lemon-scented. *Inflorescence* a decompound panicle, 60–116cm, rather narrow, primary

branches erect, widely spaced, the lowest 31–58cm, 3–4cm wide. *Spatheoles* 17–30mm, linear. *Racemes* 12–20mm, the shorter subsessile, with 1 homogamous basal pair, 1–5 spikelet pairs and 1 terminal triad; the pedicelled raceme with 3–6 spikelet pairs and one terminal triad; raceme internodes 2.3–3.5mm, marginal hairs white, the longest 1.5–2.5mm, apical cup unequally 3-lobed. *Sessile spikelet* 5–6.4mm; lower glume 4.6–5.8 × 1–1.3mm, oblong-acuminate, coriaceous, yellowish, covered in minute glands, back flat, with shallow, central groove in lower half, with 2 or 3 intercarinal veins in upper half, keels very narrowly winged above, wings 0.1–0.2mm wide, apex minutely bifid; upper glume 4.4–5.5mm, oblong-lanceolate, keeled, keel narrowly winged near apex, sometimes minutely mucronate, margins ciliate; lower lemma 3.4–5.1mm, lanceolate, hyaline, margins ciliate; upper lemma, base oblong, 1.3–2mm, apical teeth 0.7–1.9mm, awn geniculate, column 5.1–8mm, seta 6.3–10mm; anthers 1.7–2.6mm. *Pedicel* 2.1–3.7mm; pedicelled spikelet 3.9–5.8mm.

Specimens seen. BHUTAN. Mongar district: Lingtsi [Lhuntse], Kurted, 4500ft, 5 viii 1915, *Cooper* 4359 (E); below Mongar, 1300m, 24 x 1990, *Wood* 7363 (E); below Mongar, 700m, 9 xi 1991, *Wood* 7506 (E); Lingmethang, 750m, 15 ix 1995, *Pradhan & Wangdi* EG86 (E); between Mongar and the Kuru Chu, 1350m, 15 ix 1998, *NPSW* 202 (E). Tashigang district: 1km NE of Tashigang, 1330m, 18 vi 1979, *Grierson & Long* 2067 (E, K); Kiri, 1400m, 14 ix 1995, *Pradhan & Wangdi* EG50 (E); below Yadi, 820–1500m, 8 ix 1998, *NPSW* 115, 125, 126, 127, 129 (E); 2km S of Tashigang, 1380m, 14 ix 1998, *NPSW* 200 (E).

The species appears to be restricted to chir pine forest between 700 and 1500m in the hot, dry valleys of eastern Bhutan, but is to be expected in the adjacent Indian state of Arunachal Pradesh.

Cymbopogon munroi

The distinction between *Cymbopogon* and *Andropogon* is problematic, and in Bhutan two taxa highlight the difficulties. Traditionally the genera have been separated thus:

1a. Plants aromatic; raceme bases subequal, flattened, deflexed, scarcely exserted from spathes, racemes paired ——— **Cymbopogon**

1b. Plants not aromatic; raceme bases unequal, terete, not deflexed, exserted from spathes, racemes often digitate ——— **Andropogon**

But exceptions are allowed, in particular species, for all of these characters. For example, in our area *C. microtheca* (Hook. f.) A. Camus is not aromatic but has traditionally been retained in *Cymbopogon* (Soenarko, 1977; Clayton & Renvoize, 1986). Another intermediate species occurs in Bhutan, until recently known only from the inadequate type specimen collected by Griffith in 1838. This was described as *Andropogon hookeri* Hack., but transferred by Bor to *Cymbopogon*, following a suggestion of Stapf. It is extremely similar to *C. microtheca*, except in having slightly larger spikelets and non-swollen raceme internodes and pedicels.

Andropogon munroi C.B. Clarke was based on a single inadequate specimen from the Naga Hills of NE India, which I regard as atypical in having most of the racemes arranged in digitate partial inflorescences. On the type, however, there are several partial inflorescences of deflexed, paired racemes. Up until now this species has been retained in *Andropogon*, despite Clarke's comment that 'this species appears to me more a *Cymbopogon* than a *Gymnandropogon* [i.e. *Andropogon*]'. Soenarko (1977) was correct in identifying the type of *A. hookeri* as being conspecific with the earlier *A. munroi*.

Clayton (1972) added an extra complication by sinking, without discussion, the NW Himalayan *A. tristis* Nees ex Hack. and the Tibetan *C. tibeticus* Bor under *A. munroi*. This synonymy was accepted in the accounts for Pakistan by Cope (1982) and China by Chen (1997). Having examined a large number of specimens from India and China it is clear that *A. tristis* is not synonymous with *A. munroi* (see below), which leaves a problem of the correct name for the latter. Although the epithet *munroi* has priority, the generic position remains problematic. Because of the tendency of some of the racemes to deflex, and the evident close relationship to *C. microtheca*, there seems no choice but to place it in *Cymbopogon*, next to the other non-aromatic species – *C. gidarba* (Buch.-Ham. ex Steud.) Haines and *C. microtheca*. The following new combination is therefore required:

Cymbopogon munroi (C.B. Clarke) Noltie, **comb. nov.**
Basionym: *Andropogon munroi* C.B. Clarke, in J. Linn. Soc. Bot. 25: 87 (Feb. 1889). Type: India, Nagaland, Mythi Phuni, Muneypore [Manipur], 3500ft, 13 xi 1885, *Clarke* 41961 (holo. K).
Syn.: *A. hookeri* Hack. in DC. Monogr. Phan. 6: 614 (April 1889). Type: Bootan, *Griffith HEIC (KD)* 6767 [probably *Griffith* 709, descent to Tongsa, 9500ft.] (holo/iso. K).

C. hookeri (Hack.) Stapf ex Bor, in Indian For. Rec. 1: 92 (1938).

C. tibeticus Bor, in Kew Bull. 8: 275 (1953). Type: China, Tibet, Kyi Chu valley, 15 miles E of Lhasa, viii 1904, *Walton* s.n. (holo. K).

A. yunnanensis Hack., in DC. Monogr. Phan. 6: 440 (April 1889). Type: China, Yunnan, supra Mo-so-yn, prope Lan-Kong, *Delavay* 1782 (holo. P, *n.v.*).

It can be distinguished from *Andropogon tristis* as follows:

1a. Lower glume of sessile spikelet deeply grooved, linear, c.0.7mm wide; some racemes usually deflexed; most racemes paired; branching intravaginal, basal sheaths flattened, conspicuously keeled (Bhutan, NE India, SE Tibet, Yunnan) ——— **Cymbopogon munroi**

1b. Lower glume of sessile spikelet shallowly grooved, oblanceolate, c.1mm wide; no racemes deflexed; most racemes digitate; branching extravaginal; basal sheaths not conspicuously flattened or keeled (NW Himalaya, Nepal) ——— **Andropogon tristis**

Themeda

There has been confusion in herbaria over the identification of Himalayan members of this difficult genus, in particular between the widespread and very variable species *T. triandra* Forssk. and *T. quadrivalvis* (L.) Kuntze, and the less well-known *T. laxa* (Andersson) A. Camus. In the following discussion an additional complication comes from the fact that Andersson (1856) and Hooker (1897) used the genus *Anthistiria*, and both they and Hackel (1889) used different epithets for the first two species.

T. laxa was based by Andersson on a single specimen from Nepal, *Wallich* 8775. The holotype has not been seen, but isotypes at E, K and K-W all represent the same taxon and agree with the protologue, so there seems no reason to doubt that the holotype is identical. Andersson commented on its similarity to what he called *A. ciliata* (=*T. quadrivalvis*) and in particular to certain specimens in Royle's herbarium which Nees had identified as a variety of that species.

Hackel (1889) reduced *A. laxa* to a variety of what he called *T. forskalii* (=*T. triandra*). Although he listed it as a '*varietas dubia*' there is no doubt that he made a valid new combination; the doubt is over the type specimen which he thought was probably a shade form and commented that more material required to be seen before deciding on its identity.

The confusion started with Hooker (1897), who identified a Duthie specimen from the Central Provinces of India as *A. laxa*. This specimen has smaller, more hispid, involucral spikelets, and I would refer it to *T. quadrivalvis*. Hooker (1897) also described var. *roylei* of *A. imberbis* (now *T. triandra*) based on the Royle specimens mentioned above. Hooker thought this variety was probably annual, but this is difficult to tell from the specimens he saw. In fact this common Himalayan plant is perennial, the annual habit being a characteristic of *T. quadrivalvis*, which also differs in having much more hispid involucral spikelets. Stapf (on specimens at Kew), Bor (1960) and other Indian Flora writers appear to have ignored the type of *A. laxa* and misapplied the name to specimens matching the Duthie one.

The type of *A. laxa* exactly matches some Bhutanese specimens, which grade into others of what is the commonest representative of the genus in the temperate Himalayan from Simla to Bhutan. The type is atypical only in having rather numerous partial inflorescences and in the vast majority of the glumes of the involucral spikelets lacking apical bristles (though some have them). In fact *A. imberbis* var. *roylei* and *A. laxa* are one and the same thing.

T. triandra is an extremely variable species occurring throughout the tropics and subtropics of the Old World and numerous varieties have been described, based on rather subjective characters. Clayton & Renvoize (1982) comment that 'the traditional varieties are of little value', the characters being poorly correlated with distribution/habitat. Compared with other Indian material, however, the temperate Himalayan form appears relatively distinct and to merit varietal recognition. No doubt it is merely a slender montane form and similar ones have been seen from the Nilgiri Hills of southern India. It differs from the typical variety in being more

slender, having smaller clusters of spikelets, shorter spathes, less hairy, shorter involucral spikelets and shorter, weaker awns. Specimens from Khasia appear mainly to be more robust, but some are similar to var. *laxa*. In Bhutan the taxon occurs very commonly at altitudes of 1400–3200m.

Domin recombined var. *roylei* under *T. triandra*, but the epithet *laxa* has priority at varietal rank, so the following new combination and synonymy must be made:

Themeda triandra Forssk. var. **laxa** (Andersson) Noltie, **comb. nov.**
Basionym: *Anthistiria laxa* Andersson, in Nov. Act. Reg. Soc. Upsal., ser. 3, 2: 241 (1856). Type: Nepalia, *Wallich* 8775 (holo.?S *n.v.*; iso. K, E, K-W).
Syn.: *Themeda forskalii* var. *laxa* (Andersson) Hackel, in A. & C. DC., Monogr. Phan. 6: 663 (1889).

Anthistiria imberbis var. *roylei* Hook.f., Fl. Brit. India 7: 213 (1897). Type: 'N.W. India, Hb. Royle' (lecto. selected here: left hand specimen (the only one with roots), on a sheet also bearing two flowering stems collected by T. Thomson, K).

Themeda triandra var. *roylei* (Hook. f.) Domin, in Bibl. Bot. 85: 280 (1915).

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